Growing TOMATOES in hawaii

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GROWING TOMATOES IN HAWAII

Foreword

The tomato is one of the principal crops grown in Hawaii today with approximately 5½ million pounds being produced annually. The bulk of this crop is produced in the lowlands of Oahu and at the higher elevations of Kula, Maui.

Varieties

The variety to plant is determined largely by the elevation and climate of the locality. In the warm lowlands, the varieties named after the islands (Hawaii, Maui, Molokai, Lanai, Oahu, Kauai, and Niihau) are the best adapted. The mainland varieties, Manalucie, Homestead, Rutgers, Pritchard, and the hybrids Burpee's Big Boy and others, are best for the cool uplands. The "rule" might be this: island-named varieties are not adapted for high elevation growing; the mainland varieties do not fruit well at low elevations.

In recent years, the planting of F_1 hybrid tomatoes has become very popular because of the greater vigor and yielding capacities of this type. F_1 tomatoes are first generation hybrids, however, and their seeds should not be saved because most of them will fail to carry the quality of the parent plants.

F_1 hybrid seeds can be produced, however, by simply crossing two desirable varieties and saving the seeds from the fruits thus produced. *Note:* With the recent release of the rootknot nematode resistant strains of tomato by the Vegetable Crops Department of the Hawaii Agricultural Experiment Station, rootknot nematode resistant F_1 hybrids can be produced by crossing this strain with any standard variety of tomato.

Climatic Requirements

The mainland tomato varieties and hybrids require a relatively cool average temperature (60°F.–70°.) for their best yields. They will not set many fruits, however, at average (day and night) temperatures above 75°F. The island-named varieties, on the other hand, were bred by the Hawaii Agricultural Experiment Station for fruiting under the high temperature conditions of the lowlands and are therefore well adapted to lowland conditions, although not to the cool growing conditions of the higher elevations.

Soil Requirements

The tomato will thrive on any type of soil that is fairly fertile, well-drained, reasonably free from rootknot nematodes, bacterial wilt, and with a pH of 5.5–7.5.

Soil Preparation

The soil should be plowed to a depth of 8–12 inches and disked, if necessary. If irrigation is to be by furrows, the furrows should be spaced 5–6 feet apart.

If lime is needed to correct the acidity of the soil, it should be applied about a month before planting and plowed into the soil. If the soil is to be treated for nematodes, the soil fumigant DD or EDB should be applied 2–3 weeks before planting but after the field is prepared.

Seed Treatment And Planting

Tomato seeds are almost always planted in seedling flats or beds. They are rarely seeded directly in the field.

The seeds should be treated before planting with a disinfectant such as copper oxide or Arasan to control the damping-off disease which kills seeds and young seedlings.

The soil in the seedling bed or flat should be free of nematodes and soil-borne disease such as, for instance, the damping-off organisms. If soils free from nema-

tode and soil-borne disease cannot be obtained, it is best to treat the seed bed soil with either formaldehyde or methyl bromide. The formaldehyde is diluted one part to 30 parts water and applied as a drench at the rate of ½ gallon per square foot two weeks before planting. Methyl bromide (MC-2) is applied as a liquefied gas under an airtight covering over the soil. For details of soil treatment with these materials, please contact your county agent at the Agricultural Extension Service.

The treated seeds are planted either by the broadcast method or in rows spaced 1 to 2 inches apart. In either case, the seedlings should be thinned out and transplanted at a 2 X 2 inch spacing, or into individual paper cups, when they are between 1½ and 2 inches high. The seedlings will be ready for field planting about four or five weeks after seeding.

The amount of seed you must plant to produce enough seedlings for an acre depends upon the spacing to be used. An ounce of good seeds will produce approximately 2,000 plants. At 4 X 6-foot spacing, approximately 2,000 seedlings are needed. At 3 X 5-foot spacing, approximately 3,200 plants are needed.

Molokai variety of tomato grown in the lowlands of Oahu.

Seedling Care

The seedlings should be fertilized once a week with a solution made up of about a level tablespoonful of a complete water soluble fertilizer in 1 gallon of water. They should be sprayed once in 10 days with a Malathion-Zineb or a similar spray to control insects and diseases. If bacterial spot disease appears, the seedlings should be sprayed once in five days until transplanting with tri-basic copper sulfate (Two level tablespoonfuls in 1 gallon water).

Transplanting And Spacing

The seedlings should be transplanted to the field about four or five weeks after seeding, when they are between five and six inches high. Seedlings not contained in individual cans or cups, but left in seedling beds or flats, should be hardened before field planting to lessen the transplanting shock. This is especially true in hot weather. The seedlings may be hardened by reducing the amount and frequency of water and by exposing them to full sunlight if they are shaded.

The usual spacing for the bushy or determinate island types which are unpruned and unstaked is 3–4 feet between plants with the rows spaced 5–6 feet apart. For the indeterminate mainland varieties which are pruned and staked or trellised, the plants are spaced 2–3 feet in the rows, and the rows set 4–5 feet apart.

Fertilizer Application

The tomato plant will respond favorably to the application of manure or compost especially on loose, sandy soils which are very low in organic matter. A shovelful of manure should be placed 3–4 inches deep under each plant at transplanting time.

A fertilizer containing nitrogen, phosphoric acid, and potash in a ratio of 1:2:2 as found in 5-10-10 fertilizer should be ideal for most soils which are low in phosphoric acid and potash. For soils high in potash, a fertilizer with a 1:2:1 ratio as found in 5-10-5 or its equivalent should be applied.

About 1,000 to 2,000 pounds per acre of a complete fertilizer such as 5-10-10 is usually required for a crop of tomatoes. The fertilizer is best applied in two applications. The first application, consisting of ⅓ of the total fertilizer, should be applied at transplanting time in 3-inch bands, 3 inches deep and 4 inches away from the stems, on two sides of the plants. The second application, consisting of ⅔ of the remaining fertilizer, should be given after the first flower cluster appears. The fertilizer should be placed in 4- to 6-inch bands, 4 inches deep and 8 inches away from the stems on two sides of the plants.

Additional applications of nitrogen fertilizer as side dressings are usually applied after the first harvest. This side dressing may be done once a week with foliar sprays incorporated in the regular insect and disease sprays or with sulfate of ammonia at the rate of 100 pounds per acre once in four weeks.

Cultivation

The crop should be weeded whenever necessary, keeping in mind the fact that weeds harbor insects and diseases, and compete with the crop for nutrients and water. Weeds are much easier to control when they are either just emerging or are less than 2 inches high. Chemical contact weed killers, such as solvents and thinners, could be used to control weeds between the rows if sprayed properly. Care must be taken not to get the spray on the crop.

Irrigation

A wide variation in the moisture-holding capacities of the soils and the difference in rainfall in the different localities make it impossible to give a general recommendation for irrigation. As a general rule, lighter soils need more frequent irrigation than heavier soils and more water will be required for fruit-bearing plants than non-bearing plants. A steady supply of soil moisture is very important for tomatoes during fruiting time. Irregular watering may cause blossom end rots on the fruits.

Use Of Mulches

Bagasse and wood-shaving mulches may be used to advantage in reducing the weed problem and conserving soil moisture, thus reducing irrigation costs. These surface mulches should be scraped off the soil after the crop is through, then be respread after planting. If the mulching material is to be plowed into the soil after a crop, sulphate of ammonia or calcium cyanamide at the rate of 115 pounds to every ton of mulch material applied should be broadcast over the material before plowing. This will hasten the bacterial decomposition of the material. Such fields should be fallowed from six months to a year, depending upon rainfall and temperature conditions. High temperatures and moist soil conditions, plus adequate nitrogenous fertilizer materials will hasten the decomposition of the mulch materials plowed into the soil.

Insect Control

The insects most commonly found attacking the tomato are aphids, thrips, tomato bugs, leafminers, whiteflies, russet mite, broad mite, two-spotted mite, cutworms, flea beetles, pinworms, fruitworms, and melon flies.

Cutworms damage the seedlings by cutting them off near the ground level. They usually become troublesome during the spring and summer months. Cutworms may be controlled by the use of Chlordane, Malathion, or Toxaphene sprays or dusts.

The aphids, thrips, tomato bugs, whiteflies, flea beetles, leafminers, pinworms, and fruitworms may be controlled by the use of Toxaphene, Malathion-DDT or Parathion-DDT sprays. *CAUTION:* Parathion is a deadly poison. Handle and use it with great care. Read the label carefully and follow directions on packages.

Russet mites and broad mites may be controlled by sulfur. The red spider mites may be controlled by Aramite.

A general recommendation for the control of the melon fly cannot be made because there are several factors associated with its control:

1. The fly population in and around the area planted is, perhaps, the most important factor in the control of the melon fly. In the case of a very low fly population, for instance, the control is simple, while in the case of a very large population that is constantly being built up in neglected, fly-susceptible crops, control is almost impossible.
2. The kind and condition of the natural vegetation in and around the field should determine whether a border planting would be effective in melon fly control. Work done by the entomologists of the Hawaii Agricultural Experiment Station shows that the melon fly rests on the castor bean, cocklebur, and Jimson weed and other broad-leaved weeds. The planting of a corn border will help to attract the flies.
3. The aphid, scale and leafhopper or any honey dew-secreting insect infestation on the wild vegetation or other cultivated plants will attract more melon flies than those that are not infested.
4. The size of planting will also have a bearing on the effectiveness of the control measure. A small home garden planting could suffer great losses even under conditions of a very small fly population.
5. The choice of the insecticide, the frequency of application, and the thoroughness of the coverage will also determine the effectiveness of the control. DDT, Malathion, or Parathion should be sprayed twice a week under conditions of heavy fly population on the border plantings and wild, broad-leaved vegetation in and around the field. The spraying should be done thoroughly

to wet the flies, both surfaces of the leaves, and all parts of the plant.

6. Field sanitation in and around the area should be practiced to stop any build-up of the fly population. Infested fruits should be removed from the field or destroyed, and tomato and cucurbit crops should be plowed under as soon as harvesting is completed.
7. Cooperation among neighboring growers producing tomato and cucurbits in the matter of plowing under crops no longer productive should be sought to avoid melon fly population build-up. If the fly population is high and co-operation is unlikely, it may be unprofitable to plant tomato and cucurbits in the area until the fly population decreases.

Considering the above mentioned factors, the following steps should be taken toward control of the melon fly:

1. Determine the melon fly population in the area by checking on neighboring farm plantings of tomato and cucurbits for fly damage and the number of flies resting on the border plantings or natural vegetation. This would include castor bean, cocklebur, Jimson weed, pigeon peas, and other broad-leaved plants. If the population is low and the neighboring farmers are practicing good fly control measures and not building up the population through negligence, a crop may be planted with a fair assurance of reasonable success.
2. If the natural vegetation in the area is dry, bare, or does not include broad-leaved plants such as castor bean, cocklebur, Jiimson weed, and others which are attractive to the adult flies, a corn border should be planted around the field about a month before the crop is planted.
3. After the crop is planted, a frequent check of the melon fly population should be made by inspecting the undersides of the leaves of the broad-leaved plants around the field or on the corn border. As soon as melon flies appear, these plants or the border should be sprayed with DDT (4 pounds of 50% WP in 100 gallons of water) or Malathion (2 pounds of 25% WP in 100 gallons of water). The spray should be applied twice a week if the melon fly population is low, or when needed. In applying the spray a thorough coverage should be given, wetting all parts of the plants sprayed.
4. If broad-leaved weeds such as castor bean, cocklebur and others are left to grow in the field while the crop is growing, they should also be sprayed.
5. Infested fruits should be removed from the field or destroyed to prevent the build-up of flies.
6. Under home garden conditions, fruit clusters may be bagged with paper packages when they are the size of marbles. The bags may be left on until the fruit is ready for harvest.

The use of protein bait sprays for melon fly control is not to be recommended until the extensive field tests being made jointly by the USDA Fruit Fly Investigation Laboratory and the Hawaii Agricultural Experiment Station, Entomology Department, are completed.

Disease Control

The tomato plant and fruit are plagued by a great number of virus, fungus, and bacterial diseases, and a few physiological disorders. Some of the fungal and bacterial diseases can be controlled by fungicidal sprays, dusts, and seed treatments, while a few soil-borne diseases of this kind cannot be controlled by this means. Among these are the fusarium wilt, gray leaf spot, spotted wilt, and nematodes, which are controlled by the use of resistant varieties.

The island-named varieties of tomato are resistant to fusarium wilt, gray leaf spot and the spotted wilt virus. Rutgers (Kokomo) and Homestead of the mainland varieties and a few others are resistant to fusarium wilt, while Manalucie is resistant to this and also gray leaf spot, leaf mold, and Early Blight. The Hawaii Agricultural Experiment Station has produced strains of rootknot resistant tomatoes for crossing with any standard variety to produce F_1 rootknot resistant hybrids.

The foliar and stem diseases of tomato, such as Early and Late Blights, gray leaf spot, leaf mold, Septoria leaf spot, and Phomopsis can be controlled by sprays and dusts using Captan, Maneb, Zineb, or copper compounds.

Bacterial spot, which is usually carried in the seed, may be best controlled by seed treatment with bichloride of mercury, hot water, or the antibiotics Agrimycin or Agri-Strep.

Damping-off of seedlings is best controlled by seed treatment with a seed disinfectant such as copper oxide, Arasan, and others.

Virus disease such as tobacco and cucumber mosaic, blotchy ripening, and the streak virus diseases, are best controlled through control of the insects which transmit them, by destroying the weeds which may be carriers of them, and by sanitation.

Bacterial wilt is a disease for which there is no known chemical control that is economically feasible at this time; and the resistant varieties developed to date do not bear fruits of commercial quality.

Vascular browning is believed to be caused by a physiological disorder brought about by cloudy and rainy weather conditions and over-irrigation.

Blossom end rot is another physiological disorder brought about by conditions that make the plants unable to absorb enough water through their roots. This may be caused by drought conditions, root damage, or excessive transpiration.

When applying insecticides and fungicides, read the label carefully and follow directions accurately. If a chemical is not registered for use on tomatoes do not apply it to the crop. Apply the chemicals only in the amount specified and at the times specified.

If the instructions call for two pounds in 100 gallons of water per acre, use this amount and no more. If the instructions specify 14 days from last spray to harvest, do not harvest in less time than that specified. This is necessary in order that you can stay within the residue tolerance limit set by the Federal Pure Food and Drug Act.

Harvesting, Grading, And Packing

For off-island shipments the fruits should be harvested in the pink or breaking stage when the blossom end shows some color. For local sales they should be picked at the ½- to ¾-ripe stage.

Harvested fruits should be wiped clean of soil and spray residue, graded strictly according to standard regulations, and packed in uniform containers not more than 4 layers high. Standard tomato lugs are preferable.

Care should be exercised in the harvesting, cleaning, grading, and packing operations to avoid rough handling and bruising of the fruits. Bruises show up as dark scars on the fruits and lower their market value.

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